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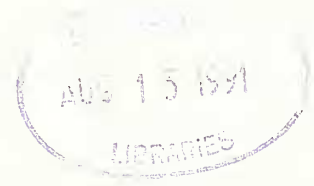
JOURNAL  
OF THE EAST AFRICA NATURAL HISTORY  
SOCIETY AND NATIONAL MUSEUM

December 1990

Volume 80, Number 196

A PROVISIONAL, ANNOTATED CHECKLIST OF THE  
BUTTERFLIES IN LAKE MANYARA NATIONAL PARK,  
ARUSHA REGION, TANZANIA.

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ABSTRACT

Lake Manyara National Park is well known for its diverse habitats and large mammals. While little is understood about most of the smaller vertebrates and invertebrates, this investigation into the butterflies of the park has revealed over 180 species. Several of the following are of particular interest, either because of new extensions to their range or, their taxonomic differences as compared to other East African populations: *Belenois margaritacea plutonica*, *Pieris brassicoides marghanita*, *Charaxes cithaeron kennethi*, *Ch. violetta melloni*, *Ch. hansalii baringana*, a female aberration of *Ch. achaemenes achaemenes* (figured and described in this paper), *Mimacraea marshalli*, *Aloeides conradsi talboti*, *Stugeta bowkeri nyanzana* and *Tuxentius stempfferi*.

INTRODUCTION

Lake Manyara National Park (L.M.N.P.) is one of the areas of highest wildlife biomass in Africa (Coe *et al.*, 1976; Loth & Prins, 1986) and is well known for its diverse fauna and flora. Although Watermeyer & Elliott (1943) initially described the general ecology, probably the most extensive earlier contribution to the ecology of L.M.N.P. is that of Douglas-Hamilton (1972). Greenway & Vesey-FitzGerald (1969), gave a detailed account of the vegetation, emphasizing the diverse habitat types and their corresponding species, whereas Loth & Prins (1986) described the physiography of the park. [see also Prins, 1988; Prins & Loth, 1988].

Most of the scientific research at L.M.N.P. has centred around vegetational changes caused by large herbivores (Vesey-FitzGerald, 1969 1973; Douglas-Hamilton, 1972; Mwalyosi, 1981 1983; Beekman & Prins, 1989; Prins & Beekman, 1989); although numerous ecological and behavioural studies have also been conducted on large mammals (Makacha & Schaller, 1969; Vesey-FitzGerald, 1969; Douglas-Hamilton, 1972; Weyerhauser, 1982; Kalemera, 1987; Beekman & Prins, 1989; Kalemera, 1989; Prins, 1989; Prins & Beekman, 1989; Prins & Iason, 1989). The changes in populations of large mammals have also been monitored over the years (Watson & Turner, 1965; Douglas-Hamilton, 1972; Mwalyosi, 1977; Boshe & Malima, 1986). Morgan-Davies (1964) recorded over 380 species of birds (TANAPA / AWF, 1986). The smaller vertebrates and invertebrate fauna, however, have received scant attention.

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Only a few people have contributed towards butterfly records. Barns (1924) and Cooper collected in the region of L.M.N.P. as early as 1921 and 1935 respectively (according to specimen labels in the collections at the Natural History Museum, London (BMNH), (personal observations). Two-and-a-half decades later, Rydon & Morgan-Davies (1960a, b, and unpublished) collected butterflies in L.M.N.P., compiling two short checklists for the park's authorities; they recorded 56 species. In the early 1970s, S. C. Collins (personal communication) also made a small collection of butterflies in the park.

This paper is an account of the butterflies recorded in L.M.N.P. as a result of a five month study made between late July and early December 1987. The main content has been divided into two sections: (1) a checklist of all the species, and (2) brief notes on over 50 of them.

The checklist is by no means an exhaustive study of the park's butterfly fauna of the park. This is particularly evident in the families *Lycaenidae*, *Acraeidae* and *Hesperiidae*, which are poorly represented. There are also habitats that require exploring in greater depth than I had undertaken, e.g. the groundwater forest, the Marang Forest and the adjoining forest below the Rift Valley wall, as well as the vegetation of the escarpment. (Fig. 1).

### Description of the study area

Lake Manyara National Park, is situated in northern Tanzania (centre of the park at 3°30'S, 35°60'E), it encompasses part of the eastern escarpment of the Rift Valley as well as the lake and a portion of the surrounding environment (Fig. 1). The lake lies at an altitude of approximately 960m, while the Rift Valley wall generally rises to about 1000m above it and in some areas is even higher. L.M.N.P. is 330 km<sup>2</sup> of which about two-thirds comprises the alkaline lake (Mwalyosi, 1981; TANAPA / AWF, 1986). The Marang Forest Reserve and an adjacent strip of land in the south of L.M.N.P. have been proposed for incorporation into the park boundaries in the near future (Loth & Prins, 1986).

Annual rainfall is variable, ranging from 480mm [1969] to 1500mm [1968] (Mwalyosi, 1981) most of which falls between November and May (Prins & Loth, 1988). There is one long dry season from June to October (Prins & Loth, 1988). Within the Lake Manyara ecosystem there are five distinct vegetation zones, namely **groundwater forest**, **marshland** and **reed beds**, **alkaline grassland**, **scrubland** on the escarpment and the **Acacia woodland** (Greenway & Vesey-FitzGerald, 1969).

## METHODS

As a result of the reorganization of the park museum, the new L.M.N.P. *Rhopalocera* collection which I re-established entailed the exploration of many vegetation zones of the park. [I replaced the moth-eaten collection made by A. M. Morgan-Davies which had been installed in the early 1960s (Rydon, *in litt.*)]. Collecting was undertaken on an irregular basis for between 1-3 days a week.

To obtain additional records, I briefly studied the African collections in the Natural History Museum, London (BMNH) and the American Museum of Natural History (AMNH) in August 1988 and July 1989 respectively.

I have followed Carcasson's "Simplified Provisional Checklist of the Butterflies of the Afrotropical Region" in his *Collins Handguide to the Butterflies of Africa* (1981) (Hard-back edition) as the basis of this checklist. The list has been organized by families and genera except for the *Lycaenidae* which was placed at the end and the *Hesperiidae* at the beginning, following the arrangement of Kristensen (1976). For simplicity these groups have not been divided into subfamilies and tribes; however, the species have been arranged alphabetically so as to facilitate easy reference by the reader:

Of special interest are *Belenois margaritacea pluonica* Joicey & Talbot, *Pieris brassicoides*

*marghanita* Hemming, *Charaxes cithaeron kennethi* Poulton, *Ch. violetta melloni* Fox, *Ch. hansalii baringana* Rothschild, and a female aberration of *Ch. achaemenes achaemenes* Felder (which is figured and described in this paper), *Mimacraea marshalli* Trimen, *Aloeides conradi talboti* Tite & Dickson, *Stugeta bowkeri nyanzana* Wichgraf, *Tuxentius stempfferi* Kielland. The significance of the above-named species to L.M.N.P. is discussed later. Other species marked with an asterisk (\*) or a question mark (?) after the author(s)' name are also discussed further in the notes section and, where appropriate, I have added additional comments on the taxonomy, behaviour and special geographical ranges. Numbers after generic and specific names refer to species notes in the discussion. Important additional information was provided to me by J. Kielland, S. C. Collins and A. H. B. Rydon.

## RESULTS

### Lake Manyara checklist

All specimens (except those recorded by other authors / collectors) are in the National Park museum or temporarily in my collection.

#### Key to the abbreviations and symbols

In the checklist, numbers preceding names refer to species mentioned in the discussion.

#### *Butterfly records other than my own*

- \* = specimens in the BMNH
- \*\* = various records from other authors or collectors
- \*\*\* = specimens in the AMNH

#### *Butterfly status at L.M.N.P.*

- x = rare
- ox = uncommon
- o = common
- oo = very common

#### *Habitat abbreviations, (after Carcasson, 1981)*

- |    |                  |    |                    |
|----|------------------|----|--------------------|
| ag | arid grasslands  | gf | groundwater forest |
| ah | arid habitats    | h  | highlands          |
| aw | arid woodlands   | hf | highland forest    |
| c  | cultivated areas | oh | open habitats      |
| f  | forest           | rf | riverine forest    |
| fm | forest margin    | w  | woodland           |
| g  | grasslands       |    |                    |

#### *Other abbreviations and symbols*

- A (?) after a habitat(s) abbreviation means that the habitat of the species in L.M.N.P. was not known to me as it was recorded by someone else. I have added the known habitat(s) in Africa according to Carcasson (1981).
- A (?) representing the status of the taxon implies that it was recorded by another person, and information on its status in L.M.N.P. is unavailable.
- A (?) after the author(s) name implies that the record is based on my observation and that it was not captured for verification.
- ssp. denotes uncertainty on the sub-specific status of the taxon, or that it is currently being described by another author.

Family, Genus & species	Status	Habitat	Family, Genus & species	Status	Habitat
<b>HESPERIIDAE</b>			<i>N. thalassina sinalata</i> Suffert	ox	rf, f
<b>Coeliades</b> Hübner			<b>Eronia</b> Hübner		
<i>C. anchises anchises</i> Gerstaecker (2)	oo	f	<i>E. cleodora dilatata</i> Butler	o	w
<b>Celaenorrhinus</b> Hübner			<i>E. leda</i> Boisduval	oo	w
<i>C. galenus</i> Fabricius	oo	gf	<b>Colotis</b> Hübner		
<b>Tagiades</b> Hübner			<i>C. antivippe zera</i> Lucas	oo	oh
<i>T. flesus</i> Fabricius	oo	w	<i>C. aurigineus</i> Butler	oo	oh
<b>Eagris</b> Guenée			<i>C. aurora dissociatus</i> Butler	oo	ah
<i>E. sabadius astoria</i> Holland	oo	gf, w	<i>C. auxo incretus</i> Butler (38)	o	w
<b>Sarangesa</b> Moore			<i>C. calais calais</i> Cramer	oo	ah
<i>S. motozi</i> Wallengren	o	w	<i>C. celimene celimene</i> Lucas	o	oh
<i>S. phidyle</i> Walker	oo	ah	<i>C. chrysonome chrysonome</i>	?	a
<i>S. seineri seineri</i> Strand	o	ah	Klug* (41)		
<b>Netrobalene</b> Mabille			<i>C. danae pseudacaste</i> Butler	oo	aw
<i>N. canopus</i> Trimen (8)	oo	oh in f, rf	<i>C. eris eris</i> Klug (43)	oo	ah
<b>Spialia</b> Swinhoe			<i>C. evagore antigone</i> Boisduval	oo	ah
<i>S. spio</i> Linnaeus** (9)	oo	oh	<i>C. evenina xantholeuca</i> Sharpe	oo	w
<b>Gomalia</b> Moore			<i>C. evippe complexivus</i> Butler	oo	oh
<i>G. elma</i> Trimen	o	oh	<i>C. halimede australis</i> Talbot	o	aw
<b>Metisella</b> Hemming			<i>C. hetaera ankolensis</i> Stoneham	oo	oh
<i>M. medea medea</i> Evans (11)	o	gf	<i>C. hildebrandti</i> Staudinger	oo	aw
<b>Ampittia</b> Moore			<i>C. ione</i> Godart	oo	w
<i>A. capenas capenas</i> Hewitson	ox	w	<i>C. pallene pallene</i> Hopffer** (51)	?	oh?
<b>Acleros</b> Mabille			<i>C. regina</i> Trimen	oo	w
<i>A. ploetzi</i> Mabille	oo	gf	<i>C. vesta hanningtoni</i> Butler	oo	oh
<b>Zenonia</b> Evans			<i>C. vestalis castalis</i> Staudinger (54)	o	ah
<i>Z. zeno</i> Trimen	oo	w	<b>Belenois</b> Hübner		
<b>Gegenes</b> Hübner			<i>B. aurota aurota</i> Fabricius	oo	oh
<i>G. hottentota hottentota</i> Latreille (15)	o	oh	<i>B. creona severina</i> Stoll	oo	oh
<b>PAPILIONIDAE</b>			<i>B. gidica</i> Godart	oo	oh
<b>Papilio</b> Linnaeus			<i>B. margaritacea plutonica</i>	x	gf
<i>P. dardanus tibullus</i> Kirby	o	f	Joicey & Talbot (58)		
<i>P. demodocus demodocus</i> Esper	oo	oh	<i>B. thysa thysa</i> Hopffer	o	w, fm
<i>P. echerioides</i> Trimen ssp.	ox	f	<i>B. zochalia agrippinides</i> Holland	o	gf
<i>P. nireus lyaeus</i> Doubleday	o	oh in f, c	<b>Pieris</b> Schrank		
<b>Graphium</b> Scopoli			<i>P. brassicoides marghanita</i>	x	h
<i>G. angolanus angolanus</i> Goeze? (20)	o	oh	Hemming (= <i>meridionalis</i> )		
<i>G. antheus</i> Cramer	o	f, fm	Joicey & Talbot (61)		
<i>G. leonidas leonidas</i> Fabricius (22)	oo	w, f	<b>Dixiea</b> Talbot		
<i>G. policenes</i> Cramer** (23)	?	f?	<i>D. charina liliana</i> Grose-Smith	o	w, fm
<b>PIERIDAE</b>			<i>D. doxo costata</i> Talbot	o	w
<b>Catopsilia</b> Hübner			<i>D. orbona vidua</i> Butler	o	oh
<i>C. florella</i> Fabricius	oo	oh	<i>D. pigea</i> Boisduval	o	w, fm
<b>Eurema</b> Hübner			<b>Appias</b> Hübner		
<i>E. brigitta brigitta</i> Stoll	oo	oh	<i>A. ephia contracta</i> Butler	oo	w, f, rf
<i>E. desjardinsi marshalli</i> Butler (26)	oo	w	<i>A. sabina phoebe</i> Butler	o	rf, f
<i>E. hapale</i> Mabille	o	g	<b>Mylothris</b> Hübner		
<i>E. hecabe solifera</i> Butler	oo	oh, w	<i>M. chloris agathina</i> Cramer	oo	w, fm
<b>Pinacopteryx</b> Wallengren			<i>M. ruppellii tirikensis</i> Neave	o	w, f
<i>P. eriphia melanarge</i> Butler	oo	oh, w	<b>Leptosia</b> Hübner		
<b>Nepheronia</b> Butler			<i>L. alcesta inalcesta</i> Bernardi	oo	f
<i>N. argia mhondana</i> Suffert	oo	rf, f	<b>LIBYTHEIDAE</b>		
<i>N. buqueti buqueti</i> Boisduval	oo	ah	<b>Libythea</b> Fabricius		
			<i>L. labdaca laius</i> Trimen (71)	o	gf, fm

Family, Genus & species	Status	Habitat	Family, Genus & species	Status	Habitat
<b>NYMPHALIDAE</b>			<i>J. limnoria taveta</i> Rogenhöfer	o	ah
<b>Charaxes</b> Ochseneheimer			<i>J. natalica natalica</i> Felder	oo	w, fm
<i>Ch. achaemenes achaemenes</i>			<i>J. octavia sesamus</i> Trimen	o	w
Felder (72)	o	w	<i>J. oenone oenone</i> Linnaeus	oo	oh
<i>Ch. aubyni aubyni</i>			<i>J. orithya madagascariensis</i> Guenée	o	oh
van Someren & Jackson (73)	ox	gf	<i>J. terea elgiva</i> Hewitson	oo	f
<i>Ch. baumanni tenuis</i> van			<b>Catacroptera</b> Karsch		
Someren	o	gf	<i>C. cloanthe cloanthe</i> Stoll	oo	g
<i>Ch. bohemani</i> Felder (75)	oo	w	<b>Vanessa</b> Fabricius		
<i>Ch. brutus alcyone</i> Stoneman	oo	f	<i>V. cardui</i> Linnaeus	oo	oh
<i>Ch. candiope candiope</i> Godart (77)	oo	f, w	<b>Antanartia</b> Rothschild & Jordan		
<i>Ch. cithaeron kennethi</i> Poulton (78)	o	gf	<i>A. abyssinica jacksoni</i> Howarth**(116)?		h?
<i>Ch. etesipe tavetensis</i> Rothschild	o	f	<b>Phalanta</b> Horsfield		
<i>Ch. ethalion littoralis</i> van Someren	oo	f, w	<i>Ph. phalantha aethiopica</i>	oo	w, oh
<i>Ch. hansalii baringana</i> Rothschild (81)x		aw	Rothschild & Jordan		
<i>Ch. jasius saturnus</i> Butler (82)	o	w, c	<b>ACRAEIDAE</b>		
<i>Ch. kirki kirki</i> Butler (83)	oo	w	<b>Bematistes</b> Hemming		
<i>Ch. pollux maua</i> van Someren (84)	ox	gf	<i>B. aganice montana</i> Butler	ox	f
<i>Ch. varanes vologeses</i> Mabille (85)	oo	w, fm	<b>Acraea</b> Fabricius		
<i>Ch. violetta melloni</i> Fox (86)	o	gf	<i>A. acerata</i> Hewitson	o	w
<i>Ch. zoolina zoolina</i> Westwood (87)	oo	w, fm	<i>A. anemosa</i> Hewitson	oo	w, f
<b>Euxanthe</b> Hübner			<i>A. braesia</i> Godman	o	ah
<i>E. wakefieldii</i> Ward (88)	o	gf	<i>A. cabira</i> Hopffer ?	o	fm, rf
<b>Hamanumida</b> Hübner			<i>A. egina areca</i> Mabille	o	f, rf
<i>H. daedalus</i> Fabricius	oo	oh	<i>A. encendon encendon</i> Linnaeus	oo	oh
<b>Pseudacraea</b> Westwood			<i>A. eponina</i> Cramer	oo	oh
<i>Ps. boisduvali trimeni</i> Butler**(90)	?	w, rf, fm?	<i>A. esebria esebria</i> Hewitson	oo	f, rf, w
<i>Ps. lucretia expansa</i> Butler	o	rf, fm	<i>A. johnstoni johnstoni</i> Godman	oo	f
<b>Neptis</b> Fabricius			<i>A. natalica natalica</i> Boisduval	oo	w, fm
<i>N. laeta</i> Overlaet	oo	w	<i>A. neobule neobule</i> Doubleday**(129) ?		oh?
<i>N. saclava marpessa</i> Hopffer	oo	w	<i>A. oreas oreas</i> Sharpe	o	gf
<b>Cyrestis</b> Boisduval			<i>A. pudorella pudorella</i>	o	w
<i>C. camillus sublineata</i> Lathy	o	gf, rf	Aurivillius? (131)		
<b>Byblia</b> Hübner			<i>A. sotikensis</i> Sharpe*(132)	?	f
<i>B. anvatarea acheloia</i> Wallengren	oo	oh	<b>Pardopsis</b> Trimen		
<i>B. ilithya</i> Drury	oo	oh	<i>P. punctatissima</i> Boisduval? (133)	o	oh
<b>Neptidopsis</b> Aurivillius			<b>SATYRIDAE</b>		
<i>N. ophione vellea</i> Mabille	oo	f, w	<b>Gnophodes</b> Westwood		
<b>Eurytela</b> Boisduval			<i>G. betsimensa diversa</i> Butler	o	f, fm
<i>E. dryope angulata</i> Aurivillius (98)	oo	w	<b>Melantis</b> Fabricius		
<i>E. hiarbas lita</i>	oo	f	<i>M. leda helena</i> West	oo	w
Rothschild & Jordan (99)			<b>Bicyclus</b> Kirby		
<b>Hypolimnas</b> Hübner			<i>B. anynana anynana</i> Butler	oo	w
<i>H. misippus</i> Linnaeus	oo	oh	<i>B. safitza safitza</i> Westwood	oo	w
<i>H. dubius wahlbergi</i> Wallengren	o	f	<b>Henotesia</b> Butler		
<b>Salamis</b> Boisduval			<i>H. perspicua</i> Trimen	oo	w
<i>S. anacardii anacardii</i>			<b>Ypthima</b> Hübner		
Linnaeus (102)	oo	w, rf, oh in f	<i>Y. granulosa</i> Butler (139)	oo	ag
<i>S. parhassus</i> Drury (103)	oo	f	<b>DANAIDAE</b>		
<b>Junonia</b> Hübner			<b>Danaus</b> Kluk		
<i>J. antilope</i> Feisthamel	o	w	<i>D. chrysippus chrysippus</i> Linnaeus	oo	oh
<i>J. archesia</i> Cramer	o	w	<b>Tirumala</b> Moore		
<i>J. cuama</i> Hewitson?	ox	w	<i>T. petiverana</i> Doubleday	oo	w, f
<i>J. hierta cebrene</i> Trimen	oo	oh			

Family, Genus & species	Status	Habitat	Family, Genus & species	Status	Habitat
<b>Amauris</b> Hübner			<i>A. larydas</i> Cramer	oo	aw
<i>A. albimaculata interposita</i> Talbot	o	gf	<i>A. otacilia otacilia</i> Trimen	o	aw
<i>A. echeria meruensis</i> Talbot**	?	hf?	<i>A. princeps princeps</i> Butler	oo	w, aw
<i>A. niavius dominicanus</i> Trimen	o	gf	<b>Petrealea</b> Toxopeus		
<b>LYCAENIDAE</b>			<i>P. sichela sichela</i> Wallengren	o	w
<b>Alaena</b> Boisduval			<b>Lampides</b> Hübner		
<i>A. caissa caissa</i> Rebel*** (145)	?	oh?	<i>L. boeticus</i> Linnaeus	oo	oh
<i>A. ferrulineata</i> Hawker-Smith** (146)	o	ah?	<b>Cacyreus</b> Butler		
<b>Mimacraea</b> Butler			<i>C. lingueus</i> Stoll	oo	w
<i>M. marshalli</i> Trimen ssp.** (147)	o	gf	<i>C. virilis</i> Aurivillius	oo	w
<b>Lachnocnema</b> Trimen			<b>Leptotes</b> Scudder		
<i>L. bibulus</i> Fabricius (148)	oo	u	<i>L. jeanneli</i> Stempffer* (171)	?	w?
<b>Myrina</b> Fabricius			<i>L. pirithous pirithous</i> Linnaeus	oo	w
<i>M. silenus ficedula</i> Trimen	o	rf, w	<b>Tuxentius</b> Larsen		
<b>Aloeides</b> Hübner			<i>T. melaena melaena</i> Trimen	o	aw
<i>A. conradi talboti</i>	?	oh?	<i>T. stempfferi</i> Kielland (174)	x	w
Tite & Dickson** (150)			<b>Taracus</b> Moore		
<b>Epamera</b> Druce			<i>T. grammicus</i>	oo	ag
<i>E. mimoseae rhodosense</i>	?	w?	Grose-Smith & Kirby (175)		
Stempffer & Bennett** (151)			<b>Zizeeria</b> Chapman		
<i>E. tajoraca ertli</i> Aurivillius** (152)	?	aw?	<i>Z. knysna</i> Trimen	o	oh
<b>Stugeta</b> Druce			<b>Acticera</b> Chapman		
<i>S. bowkeri nyanzana</i> Wichgraf (153)	o	w	<i>A. lucida</i> Trimen	o	oh
<b>Hypolycaena</b> Felder			<b>Zizula</b> Chapman		
<i>H. pachalica</i> Butler	o	aw	<i>Z. hylax</i> Fabricius	oo	oh
<i>H. philippus philippus</i> Fabricius	oo	w, f	<b>Azanus</b> Moore		
<b>Virachola</b> Moore			<i>A. jesous</i> Guérin de Ménéville	oo	oh
<i>V. antalus</i> Hopffer	oo	oh	<i>A. mirza</i> Plötz	oo	aw
<i>V. dinochares</i> Grose-Smith	oo	w	<i>A. moriqua</i> Wallengren	o	oh
<i>V. livia</i> Klug	o	ah	<i>A. natalensis</i> Trimen	ox	oh
<b>Anthene</b> Doubleday			<b>Euchrysops</b> Butler		
<i>A. amarah amarah</i>			<i>E. malathana</i> Boisduval	oo	oh
Guérin de Ménéville	oo	ah	<i>E. osiris</i> Hopffer	oo	oh
<i>A. contrastata mashuna</i> Stevenson	oo	ah	<i>E. subpallida</i> Bethune-Baker	oo	oh
<i>A. definita definita</i> Butler	oo	w	<b>Freyeria</b> Courvoisier		
<i>A. indefinita</i> Bethune-Baker	oo	f, rf	<i>F. trochilus trochilus</i> Freyer	oo	oh
<i>A. kersteni</i> Gerstaecker	o	w, f			

## DISCUSSION

### Notes

(2) *Celaenorrhinus galenus*. Understorey trees in the groundwater forest are favoured as territorial perches from which the male of this species swoops down on intruders. I observed that three or more males often occupied territories a few metres apart along road-sides, the edges of forest glades, and other open habitats within the forest. During such times, I saw two males "tumbling" over each other in the air, sometimes joined by a third or fourth party (n=17). Females crossing the paths of these males would be fought for by, usually, two males which would "tumble" over each other in the air and separate, one heading back towards its perch whilst the other pursued the female. Sometimes the female would avoid her pursuer, but on other occasions she would be forced to the ground in order to mate.

(8) *Netrobalene canopus*. Males of *N. canopus* are very territorial, occupying territories in open habitats throughout the groundwater forest. Each male perches on a favoured leaf of a branch that extends far out from the canopy of an understorey tree, often at approximately 2m from the ground. For five consecutive days I observed three males that shared territories on different branches of the same tree, also occupied by a male *Graphium leonidas*. They did not interfere with *G. leonidas* (or *vice versa*) but would fight amongst themselves for hours on end. First one male would fly into the territory of another and then an attack commenced whereupon the intruder was "tussled" with in the air. During such aerial "battles", both would enter the territory of a third male, resulting in all three attacking each other. After several minutes of contest, one male would return to its perch. After further and short aerial combats, the other two would also retreat to their perches.

(9) *Spialia spio*. This species was collected in L.M.N.P. (Rydon & Morgan-Davies, 1960a and unpublished). Three other species of this genus that might occur in L.M.N.P., especially along the escarpment, are *S. colotes transvaaliae*, *S. mafa higginsii* and *S. zebra bifida*. The two former species inhabit hilly and mountainous regions and have been recorded in the "Great Craters" (de Jong, 1978), referring to the Ngorongoro Highlands. The latter species has been recorded in Oldeani (de Jong, 1978), which is a part of these highlands.

(11) *Metisella medea* is common in the groundwater forest and the forest at the southern end of L.M.N.P. However, I rarely found it flying in the woodlands at the Ndala Research Camp, suggesting that it might, occasionally, penetrate densely-wooded areas.

(15) *Gegenes hottentota hottentota*. This species often flies together with *G. nico brevicornis* (Plötz), the latter insect being more common, according to Kielland (*in litt.*) who postulates that *G. nico brevicornis* should also occur in L.M.N.P.

18) *Papilio echerioides* ssp. A new subspecies of *Papilio echerioides* from the southern Kenya highlands and north and eastern Tanzanian mountains is currently being described by Kielland (*in press*). This species was rarely seen in the groundwater forest in the north of the Park. However, in the forest near the Yambi River area, the species flew in slightly greater numbers. Although I did not survey the Marang Forest on the escarpment, *P. echerioides* is much commoner in this higher altitude forest (Kielland, *in litt.*), and it is possible that a few individuals may migrate down into the lower forests.

20) *Graphium angolanus angolanus*. Not a positive identification because I did not manage to secure any specimens. The specimens that were flying at L.M.N.P. superficially resembled *G. angolanus*. As the species is well-spread across East Africa (D'Abrera, 1980; Carcasson, 1981) it is possible that it was *G. angolanus* and not any other *Graphium* of the *pylades* group. Kielland (*in litt.*) tells me that it is most definitely *G. angolanus*.

(22) *Graphium leonidas leonidas*. The male of this species is territorial, perching on understorey trees in the forest and constantly driving off intruders. Its territorial behaviour is similar to the male of *Euxanthe wakefieldii*, which also occupies open habitats in the groundwater forest. Thus the two insects can often be found flying within the same patch of forest. I think that *G. leonidas* and *E. wakefieldii* confuse their predators by resembling each other in colour, pattern and behaviour (as well as their distasteful model *Tirumala petiverana*, which also flies in the same habitat).

(23) *Graphium policenes*. Recorded by S. C. Collins (personal communication) as occurring in L.M.N.P.

(26) *Eurema desjardinsi marshalli*. Typical *E. desjardinsi* occurs in Madagascar and the Comoros (D'Abrera, 1980; Carcasson, 1981). D'Abrera (1980) had recognised the African mainland subspecies as *E. regularis*, however, Berger (1980) subsequently revised the *E. desjardinsi-regularis* complex, raising both to species rank. Thus, the African mainland subspecies of *E. desjardinsi* has been given the next available name *E. marshalli* (Berger, 1981). Kielland (*in litt.*) states that both *E. desjardinsi* and *E. regularis* sometimes fly in the same habitats, though *E. desjardinsi* is the commonest. He also mentioned that it is possible that *E. regularis* also occurs at L.M.N.P.

(38) *Colotis aurora dissociatus*. D'Abrera (1980) had named this insect as *C. eucharis dissociatus*. Berger (1981) recently changed the name to *C. aurora dissociatus*.

Several species of *Colotis* were preyed on by robber flies (*Alcimus* spp., Diptera: Asilidae). Adult robber flies wait for their prey and then attack them in the air, relying primarily on sight (Shelly, 1987). Upon capturing prey species, robber flies then settle down and consume the body fluids of the victim (Shelly, 1987).

At L.M.N.P., individual robber flies utilized open conspicuous sites in which to stake out their territories. For this reason I often observed robber flies along road-sides in the woodlands, and occasionally on forest paths. A robber fly would perch on grass at the road's edge and, when it saw a flying insect it would fly out and attack it in the air. The robber fly would then pin the victim on the ground, secure its hold, and fly off into the grasses where it would begin to consume the body fluids. After feeding on the victim it would then drop it in the grass and fly off to its perch, ready to capture another insect. Slow-flying butterflies, like *Appias* spp., *Belenois* spp., *Eurema* spp., and some Lycaenids (see note 148), were among those fed upon after capture.

(41) *Colotis chrysonome chrysonome*. There is a record of *C. chrysonome* in the BMNH collected by B. Cooper in July 1938 from "Ngaruka, north of L. Manyara" (personal observations) and below Mt. Oldeani in the Ngorongoro Highlands (Kielland, *in litt.*).

(43) *Colotis eris eris*. A very common species, especially in the arid grasslands at the southern end of the lake. At times *C. eris* would frequent the *Acacia* woodlands but in smaller numbers.

(51) *Colotis pallene pallene* has been recorded by T. A. Barns in the "District of Great Craters, [ii.-iii. 1921]" (Talbot, 1939), referring to the Ngorongoro Highlands region.

(54). *Colotis vestalis castalis* is not a very common species at L.M.N.P. It occasionally flies among the *Acacia* woodlands and alkaline grasslands.

(58) *Belenois margaritacea plutonica* is mainly a montane species, and for it to occur at a much lower altitude is an interesting record. I have also recorded this species at 900m in the Rau Forest Reserve in Moshi, about 800m below its normal altitudinal range on Mt. Kilimanjaro (Cordeiro, *in preparation.*). Both low altitude populations are most likely to be ecological variants.

(61) *Pieris brassicoides marghanita* (= *meridionalis*). Only one specimen was observed and identified as belonging to this species, based on the underside pattern. I saw it in the lacustrine woodlands around the Ndala Research Camp (Fig.1). This locality is much hotter and drier than its typical montane grassland (in association with forest) habitat in the Ethiopian highlands, and on Ngorongoro and Mt. Meru in northern Tanzania (Carcasson, 1964), thus it is unlikely that a population exists at L.M.N.P. As *P. brassicoides* occurs higher up in the Ngorongoro Highlands (D'Abrera, 1980; Carcasson, 1981; Kielland, *in litt.*, Rydon, *in litt.*) north-west of L.M.N.P.; it is likely that the specimen drifted downhill with the wind. Wind-assistance of lepidoptera on



mountains has been noted before by some authors (Salt, 1954; Robbins & Small, 1981). For example, in a study on wind-dispersal in Panamanian hairstreaks, Robbins & Small (1981) found that some high-altitude species were observed 5 km downwind from their normal habitats, this being due to the seasonal trade winds.

Kielland (*in litt.*), however, thinks that its occurrence in L.M.N.P. "is very unlikely" and suggests that it should be collected for verification. Rydon and Collins are both of the same opinion.

This taxon is interesting from a zoogeographical perspective as it is the only species of the Palaearctic genus *Pieris* occurring in Africa (Carcasson, 1964; D'Abrera, 1980; Rydon, *in litt.*). It is unusual and a baffling phenomenon that this species is found below the equator and yet that it has strong affiliations with the Palaearctic butterfly fauna.

(71) *Libythea labdacca laius* frequents river banks and the groundwater forest. It flies close to the ground, darting around in a typical Hesperiid fashion, often settling on damp sand to probe with its proboscis for moisture.

(72) *Charaxes achaemenes achaemenes*. An aberrant female of *Ch. achaemenes* was baited in the lacustrine woodlands in the vicinity of the Ndala Research Camp. It was unusual in having an extensive blue-grey hind wing patch. Recently, Henning (1988: 228) figured a similar-looking aberration. Henning (*in litt.*) states that the extensive 'grey' hind wing patch in the figured specimen should actually be more bluish-green. The colouring of that plate is therefore somewhat misleading. Similar aberrations are known to occur in *Ch. jasius saturnus* (Henning, *in litt.*). As Henning has not given this aberration a name, I am taking the opportunity of doing so myself here: *Charaxes a. achaemenes* ab. *glaucomaculata* nov. (female) (Plate 1) (c.f. aberration figured in colour on p. 228 of S. F. Henning *Charaxinae Butterflies of Africa*, 1988).

**Description:** Fore wing length: 36mm. *Upperside:* Pattern and colouration of *f.w.* typical *Ch. a. achaemenes*. Hind wing with a diffuse bluish-grey area extending inwards from between the anal angle and vein 6 (M1). The bluish-grey obscuring to a certain extent the submarginal series of white spots and reaching almost as far as the middle of the wing; colouring and markings otherwise typical *Ch. a. achaemenes*.

*Underside:* Typical *Ch. a. achaemenes* pattern.

Holotype (female): Ndala Research Camp, Lake Manyara National Park, Arusha Region, Tanzania, 960m, 9. ix. 1987, N. J. Cordeiro.

Specimen to be deposited in the Natural History Museum, London.



**Plate 1.** *Charaxes achaemenes achaemenes* (Felder) (female) ab. *glaucomaculata* nov.

- (73) *Charaxes aubyni aubyni* inhabits montane / sub-montane forests in East Africa. The population in the groundwater forest at L.M.N.P. is probably an ecological variant as it occurs in a habitat that is somewhat below its normal altitude range.
- (75) *Charaxes bohemani*. There was a battered specimen with no label in the park museum, which was probably collected by Morgan-Davies, as he had curated the insect collection during the early 1960s (Rydon, personal communication). This taxon, was not recorded in the Rydon & Morgan-Davies's checklists (1960a, b and unpublished). It was very common in the *Acacia* woodlands at the southern end of the park but less common in the mixed woodlands in the north.
- (77) *Charaxes candiope candiope* is a very abundant species in the groundwater forest, but occurs in fewer numbers in the *Acacia* woodlands. It was observed feeding on exudations from *Kigelia africana* Lam. (Bignoniaceae) (n=35) throughout the park together with *Euxanthe wakefieldii* and *Ch. varanes* (see note 85). *Charaxes candiope* is a very aggressive butterfly, often molesting rivals of the same species or other members of the genus. *Euxanthe wakefieldii* was not disturbed by *Ch. candiope*, and both were frequently seen imbibing at the same wound (n=29). For interactions with *Ch. varanes*, see note 85.
- (78) *Charaxes cithaeron kennethi*. The L.M.N.P. population of *Ch. cithaeron* has been placed to *kennethi* by van Someren (1964: 232) who, however, qualified his action by saying that "the specimens from Arusha and Lake Manyara are less stable than typical coastal material." L.M.N.P. is possibly the western-most extent of this subspecies range.
- (81) *Charaxes hansalii baringana*. van Someren (1971, Map 2) records this species between Lakes Eyasi and Manyara, though he does not state the actual locality. I recorded *Ch. hansalii* in the lacustrine woodlands and on the escarpment where it apparently flies in very small numbers. Lequeux, (*in litt.*) tells me that this species is very local. In Rwanda he found it to be very common in a small area.
- (82) *Charaxes jasius saturnus*. This species flew in the woodlands and cultivated areas around the park, often probing the Castor Oil plants *Ricinus communis* Linn. (Euphorbiaceae) with its proboscis.
- (83) *Charaxes kirki kirki*. Rydon (1982), in his revision of the *Charaxes viola* group, has reinstated *Ch. kirki* to its original rank of full species removing its sub-specific status. Henning (1988) has accepted this revision.
- (84) *Charaxes pollux maua*. Typically a sub-montane / montane species, *pollux* was occasionally seen few in the lower altitude groundwater forest at the north end of the park.
- (85) *Charaxes varanes vologeses* was seen feeding on the sap of *Kigelia africana* with *Ch. candiope* and *Euxanthe wakefieldii*, along the forest margin at the north end of the lake (n=27 from September-December). *Charaxes varanes* showed an intolerant behaviour to the latter two species in that it always fed from a smaller sap source, away from *Ch. candiope* and *E. wakefieldii*. On most occasions when *Ch. varanes* came to feed, *Ch. candiope* would arrive to chase it away by a constant beating of wings (n=15). On three other occasions *Ch. candiope* did not exhibit rivalry towards *varanes*. I believe that the inferiority of *Ch. varanes* to *Ch. candiope* often led to the former species arriving at the food source to feed in the early mornings (0700-0900h) and evenings (1730-1830h) if weather permitted (n=21). *Charaxes candiope* was rarely present during these periods (n=2/21). Henning (1988) further provides evidence of the intolerance by competitors of *Ch. varanes* when he mentions that the butterfly establishes territories on the slopes rather than the

tops of hills, thus escaping molestation from hill-top territorial *Charaxes*. According to Rydon, (*in litt.*), however, *Ch. lacteinctus* Karsch (which maintains territories on hill-tops) chases *Ch. varanes* on the Tororo Hills (Uganda) and on the kopjes at Kabras (Kenya), even though *Ch. varanes* keeps lower down and tries to avoid contact with *Ch. acteinctus*. Nevertheless, on one occasion in November, I observed a battered specimen of *Ch. varanes* twice driving off a female of *Ch. zoolina*, suggesting that *Ch. varanes* is not inferior to all members of the genus, at least not to the smaller species, as I have observed elsewhere in eastern Africa.

(86) *Charaxes violetta melloni*. van Someren (1966) mentions that the aggregate from "Tanzania: Newala, Iringa, Morogoro area, the higher zones of the Usambara Mts., and the area west of Kilimanjaro (Arusha-Meru)" represents the form/cline *Ch. melloni* Fox. More recently, this taxon was raised to subspecies rank (Henning, 1988). The population at L.M.N.P. probably represents the western and northern-most extent of range of this subspecies.

(87) *Charaxes zoolina zoolina*, is a very common species of diverse habitats, and was observed feeding on exuding sap from two different tree species in September. In its lacustrine woodland habitat *Ch. zoolina* showed a preference for the juices of *Maerua triphylla* A. Rich. (Capparaceae), whereas in the groundwater forest it imbibed at wounds on *Croton macrostachyus* Del. (Euphorbiaceae) and a number of other unidentified forest trees. For further notes on inter-specific interactions see note 85.

88) *Euxanthe wakefieldii*. The behaviour and possible mimetic associations of this insect at L.M.N.P. has been recorded elsewhere (Cordeiro, 1988). Both sexes are partial to the exudations of *Kigelia africana*. The males are very territorial, driving away intruders from favoured perches at the edges of forests or in open areas in the forest. Females are uncommon, and are usually seen flying in the early mornings and late afternoons. For further information on the ecological relationships of this insect with some *Charaxes*, see notes 77 & 85.

(90) *Pseudacraea boisduvali trimeni*. Although a common species throughout its range, I did not identify *boisduvali* at L.M.N.P., S. C. Collins (personal communication) mentioned that it does occur there.

(98, 99) *Eurytela dryope angulata* and *E. hiarbas lita* fly in the understorey of forests and can often be seen feeding with the smaller species of *Charaxes*. When they do feed on the same tree as the larger *Charaxes* and beetles (Coleoptera), they are often to be found on the more distant wounds because the latter competitors tend to be very aggressive towards the smaller species of Nymphalidae.

(102, 103) *Salamis anacardii anacardii* and *S. parhassus*. Open habitats within the forest are often favoured by these species in order to bask in the sun whilst perched on sun-lit branches. During periods of intense heat they take refuge in shaded spots or hang upside-down underneath large leaves. I came across both species feeding on elephant dung several times (n=7), together with some members of the Pieridae and/or Lycaenidae.

(108) *Junonia limnoria taveta*. D'Abbrera, (1980) mentions that this taxon occurs "in the extreme north of Tanzania". I believe that the range of ssp. *taveta* in Tanzania extends from the north-east of the country westwards to the Great Rift Valley, as I have recorded this species from Kilimanjaro to Babati (Arusha region).

(116) *Antanartia abyssinica jacksoni*. This species is common in forests of the Ngorongoro Highlands, north-west of the lake. I did not observe *abyssinica* in the groundwater forest of

L.M.N.P. although Howarth (1966) mentions that it occurs on the western shore, possibly suggesting the Marang Forest where it does occur (Kielland, *in litt.*).

(127) *Acraea johnstoni johnstoni* was very common in the groundwater forest. It was also recorded from the lacustrine woodlands, where it was encountered infrequently together with *A. esebria*. It is typical that this sub-montane/montane butterfly was found in an arid woodland habitat at times, although Kielland (*in litt.*) notes that *A. johnstoni* often penetrates dense woodland when its forest habitat is not far away.

(129) *Acraea neobule neobule*. This taxon was identified as *A. terpsicore* in Rydon & Morgan-Davies's checklist (1960b, and unpublished). Kielland (*in litt.*) notified me that Pierre (1978) recently separated *A. neobule* from *A. terpsicore* on the basis that the *A. terpsicore* has an Oriental distribution and different genitalia.

(131) *Acraea pudorella pudorella*. I observed several specimens that resembled *A. pudorella*, flying in the mixed woodland throughout most areas in L.M.N.P. but did I not capture any specimens for verification.

(132) *Acraea sotikensis* is probably a common species in the Marang Forest on the escarpment, and in the forest at the southern end of the lake. However, I did not manage to fully explore either habitats and thus record the species. Nevertheless, B. Cooper (coll. BMNH), in July 1938, obtained specimens of *A. sotikensis* "along [the] western shore in forest between lake and rift wall, Manyara".

(133) *Pardopsis punctatissima*. I might have seen this species flying in the arid grassland areas. Kielland, (*in litt.*) notes that *P. punctatissima* might inhabit the Maasai plains in northern Tanzania as it is a woodland and open-habitat species that occurs throughout Africa south of the Sahara.

(139) *Ypthima granulosa*. Kielland, (1982) says that *Y. granulosa* inhabits "open, deciduous woodlands". I found that it was more common in grassy-shrubby areas in the southern half of L.M.N.P., although it was also seen in smaller numbers in the *Acacia* woodlands.

(143) *Amauris echeria meruensis*. Talbot, (1940) mentions that this taxon was collected by B. Cooper at "Lake Manyara, 3,000ft, vi-vii. 1937".

(145) *Alaena caissa caissa* occurs in "Manyara" [v. 1944, *leg?*, A. M. N. H.]. Kielland, (*in litt.*) notes that it is a very common species in this area.

(146) *Alaena ferrulineata*. D' Abrera (1980) states that this insect has been recorded at "Ngorongoro Crater and Lake Manyara".

147) *Mimacraea marshalli*. S. C. Collins (personal communication) was apparently the first person to collect this species in L.M.N.P. It is common in the understorey of the groundwater forest, often fluttering gently and settling on lichen-covered tree trunks. The Lake Manyara population is quite distinct in pattern from ssp. *dohertyi* Rothschild which occurs in the Kenya highlands (East of the Rift Valley) and at Mt. Meru in Tanzania. Rydon (*in litt.*) collected many specimens of the form *dohertyi* at Karamu and Lake Duluti in the foothills of Mt. Meru in April 1960. He only caught one specimen of f. *marshalli* which was larger than the specimens of f. *dohertyi*. Kielland (*in litt.*) thinks that the L.M.N.P. population is a cline between ssp. *dohertyi* and ssp. *marshalli* Trimen.

(148) *Lachnocnema bibulus*. This insect was often preyed upon by the *Alcimus* sp. For more information on the predatory behaviour of the robber fly, see note 35.

(150) *Aloeides conradsi talboti*. Tite & Dickson, (1973) state that T. A. Barns and B. Cooper recorded *B. talboti* at the "north end of Lake Manyara" [ii. 1921] and on the "west shore of Lake Manyara" [ii. v. 1935] respectively. This taxon is interesting from a zoogeographical viewpoint, as it is one of three species of the genus *Aloeides* located in Tanzania, the genus itself being mainly represented in southern Africa with over 30 species (D'Abbrera, 1980). *Aloeides conradsi* has been recorded in the Ngorongoro Highlands (Tite & Dickson 1973; Kielland, *in litt.*), Singida and areas around Tabora (Kielland, *in litt.*) as ssp. *talboti*. West of Mt. Longido ssp. *jacksoni* occurs whereas [near] ssp. *angoniensis* occurs in western Tanzania at Kigoma and Mpanda (Kielland, *in litt.*). In southern Africa *Aloeides* ssp. generally inhabit grassland areas in a region of distinct seasons, quite unlike that of the equatorial regions. It is therefore of great interest that *A. conradsi* should be found some thousands of kilometres away to the north, in an environment that closely approaches the alpine climate. *Aloeides conradsi* has apparently adapted to moderately high-altitude grassland areas in eastern Africa, thereby living in weather conditions similar to those found in southern Africa.

(151) *Epamera mimoseae rhodosense*. Recorded at L.M.N.P. by S. C. Collins (personal communication). He observed this species breeding on *Loranthus* spp. (Loranthaceae).

(152) *E. tajoraca ertli*. S. C. Collins recorded this taxon feeding on *Loranthus* spp. at L.M.N.P.

(153) *Stugeta bowkeri nyanzana*. D'Abbrera (1980) states that the localities of this taxon in Tanzania are in the "southern and eastern shores of L. Victoria and Ukerewe Is." Kielland (*in litt.*) states that this race also occurs in the region of the Northern Highlands. I found this insect to be very common in the lacustrine woodlands, often settling on bushes for long periods of time, apparently basking in the sun.

(171) *Leptotes jeanneli*. B. Cooper collected this species at "Ngaruka" [2,800 ft, vi-viii, 1937], north of Lake Manyara. Kielland, (*in litt.*) mentions that the *Leptotes* species are very difficult to identify without dissection of the genitalia. However, he postulates that it is probable that *L. pulchra* Murray inhabits the marshy areas in L.M.N.P.

(174) *Tuxentius stempfferi*. Larsen (1982) separated the African '*Castalius*' from the Oriental *Castalius* on the basis that the genitalia of both groups were radically different. He proposed the new generic name *Tuxentius* for the African species. Kielland, (1976) described *T. stempfferi* which is closely related to *T. melaena*. Kielland, (*in litt.*) identified a specimen that closely resembled typical *T. stempfferi*. This taxon has also been collected in nearby Oldeani in the Ngorongoro Highlands and as far away as Mikumi in Morogoro Region, (Kielland, 1976). That it has not been recorded in between the two distant localities is not surprising as Tanzania has been poorly collected and studied with regard to lepidoptera, and hence *T. stempfferi* may easily occur in many more places.

(175) *Tarucus grammicus*. A very common species of the *Acacia* woodlands, has a preference for open, arid grassy habitats, as found in the *Acacia* woodlands which elephants have disturbed. The flight of this insect is weak and low, but due to its dark-brown upperside and zebra-patterned underside, I often lost sight of it in the long grass. When in flight, I think that the overall pattern and colours of *T. grammicus* enable it to escape from predators through this "disruptive colouration" - analogous to the effect created by the stripes of a zebra when seen from a distance.

## ACKNOWLEDGEMENTS

I am especially grateful to Professor K. Hirji of the Serengeti Wildlife Research Institute (SWRI) and Mr. E. Kishe for giving me permission to work and conduct research in Lake Manyara National Park. Mr. C. Malima and Ms. P. Loesche I thank for their encouragement in my wildlife interests and for their support in this project whilst I was in Manyara. I am also thankful to the following who helped me in various ways: M. Boehnke, Y. Bouziane, M. Burengo, S. and L. Cordeiro, Dr. S. F. Henning, C. Gonzalez, M. Grossman, D. Harrison, Josephu and family, J. P. Lequeux, J. Timothy Mushi, E. Nyka, B. Orr-Wise, J. Osborne, and the Wardens and staff of L.M.N.P. I am grateful to my parents, Mr. and Mrs. H. J. Cordeiro, who encouraged my interests in Manyara.

I am also grateful to Professor B. Wisner and the "Hampshire College Henry Luce Food, Resources and International Policy Program" for some financial assistance in the preparation and publication of this paper. My special thanks go to Mr. P. R. Ackery and Dr. F. H. Rindge for allowing me to study the African butterfly collections in the Natural History Museum, London and the American Museum of Natural History respectively. I express my deep gratitude to Mr J. Kielland who identified some of the difficult species and also contributed a lot of information on many of the species included in this list. Mr. S. C. Collins and Dr. A. H. B. Rydon also added a wealth of their knowledge to this paper for which I am very grateful. Initial drafts of this paper greatly improved as a result of the constructive criticism and advice of Dr. C. D'Avanzo, Messrs. J. Kielland and P. Ackery, Dr. A. H. B. Rydon (who has also corrected and redrafted parts of this paper), and two anonymous referees, to all of whom I am greatly indebted.

This is a Serengeti Wildlife Research Institute publication.

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The East Africa Natural History Society is most grateful to Barclays Bank of Kenya for their generous contribution towards the cost of publishing this Journal part.

Manuscript received 11 April 1990

Editor: C. F. Dewhurst

Published by: The East Africa Natural History Society • Typesetting by The Print Shop • Printed by AMREF



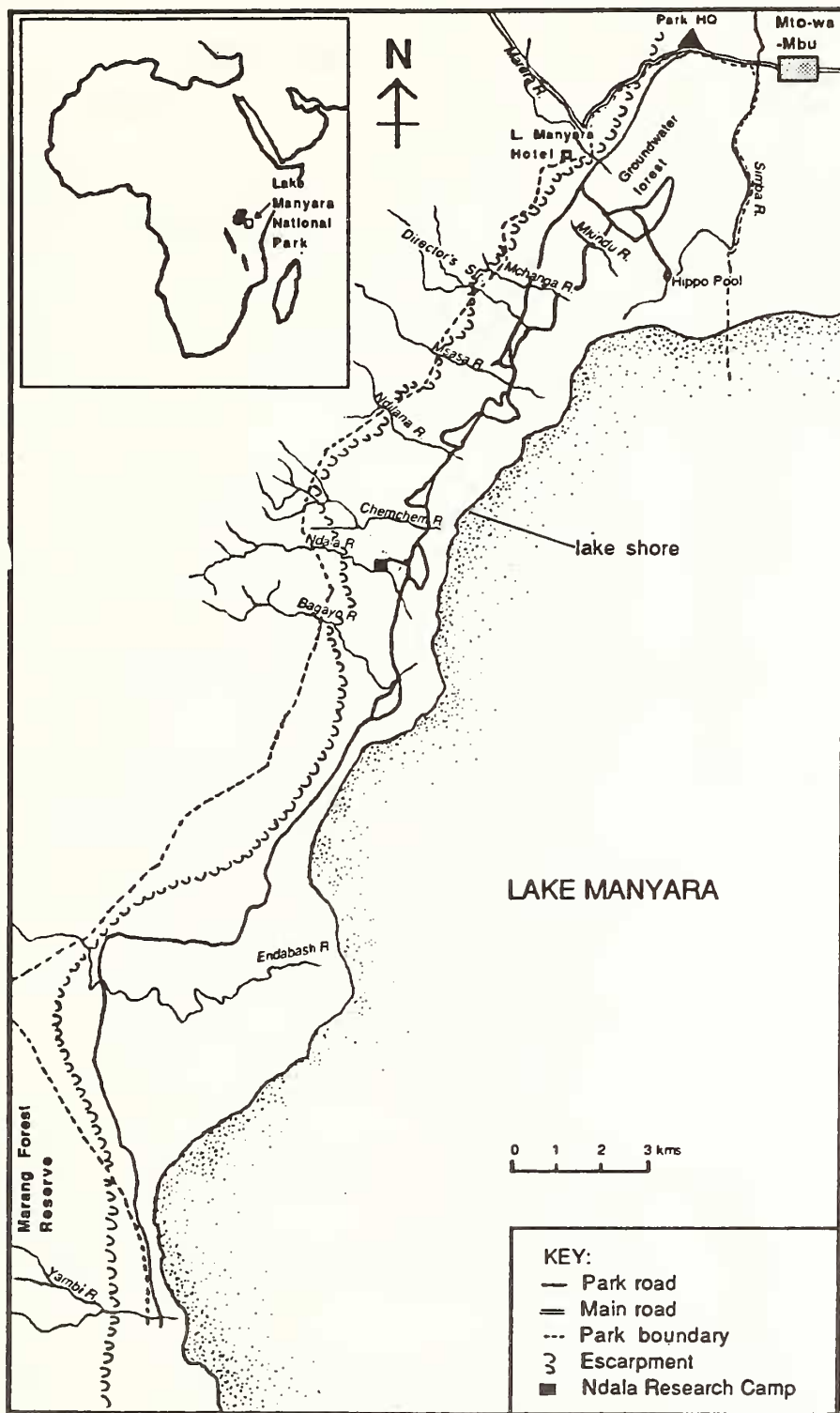


Figure 1. Sketch Map of Lake Manyara National Park. (For more detail, see "Landscape ecological vegetation map of Lake Manyara National Park, Tanzania" [Loth & Prins 1986]).